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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/715,568	11/19/2003	Setsuo Mishima	Q78557	5060
23373	7590	11/21/2005	EXAMINER	
SUGHRUE MION, PLLC 2100 PENNSYLVANIA AVENUE, N.W. SUITE 800 WASHINGTON, DC 20037				MCNELIS, KATHLEEN A
ART UNIT		PAPER NUMBER		
		1742		

DATE MAILED: 11/21/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>
	10/715,568	MISHIMA ET AL.
	<b>Examiner</b>	<b>Art Unit</b>
	Kathleen A. McNelis	1742

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) Responsive to communication(s) filed on 14 April 2004.
- 2a) This action is FINAL.                    2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) Claim(s) 1-8 is/are pending in the application.
  - 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) Claim(s) \_\_\_\_\_ is/are allowed.
- 6) Claim(s) 1-8 is/are rejected.
- 7) Claim(s) \_\_\_\_\_ is/are objected to.
- 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on \_\_\_\_\_ is/are: a) accepted or b) objected to by the Examiner.  
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) All    b) Some \* c) None of:
    1. Certified copies of the priority documents have been received.
    2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
    3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date: _____  |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>4/14/2004 and 1/12/2004</u> , | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
|  | 6) <input type="checkbox"/> Other: _____                                    |

### Claims Status

Claims 1-8 are as originally submitted on 19 November 2003.

### DETAILED ACTION

#### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 5 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The phrases:

- "...oxide inclusions having a size of not more than 20  $\mu\text{m}$  in maximum length..." and
- "...the oxide inclusions comprise spinel form inclusions and alumina inclusions in which a content rate of the spinel form inclusions having a size of not less than 10  $\mu\text{m}$  in length to a total content of the spinel form inclusions having a size of not less than 10  $\mu\text{m}$  in length and the alumina inclusions having a size of not less than 10  $\mu\text{m}$  in length is more than 0.33"

are indefinite. It is not clear if some or all spinel inclusions are less than 20  $\mu\text{m}$  in length and at least 10  $\mu\text{m}$ , if at least 33 % of the spinel inclusions are at least 10  $\mu\text{m}$  in length, at least 33% of the sum of all alumina and spinel inclusions are at least 10  $\mu\text{m}$  in length or if 33% of only the alumina inclusions are at least 10  $\mu\text{m}$  in length. For purposes of examination it has been interpreted that all of the alumina and spinel

inclusions are less than 20  $\mu\text{m}$  in length since they are oxides, and some alumina and some spinel form inclusions have a particle size of at least 10  $\mu\text{m}$ .

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Coutu (U.S. Pat. No. 6,663,730) in view of Uehara et al. (U.S. Pat No. 6,562,153).

Coutu discloses a method for producing maraging steel (abstract) by producing a consumable steel electrode for vacuum remelting and subsequently subjecting the consumable electrode to remelting (col. 2 lines 31-45). The resulting ingots are worked into strips undergoing plastic deformation (abstract and col. 2 lines 46-51).

Coutu does not teach that the consumable electrode should comprise not less than 5 ppm Mg as in instant claim 1.

Uchara et al. teaches that the addition of Mg to steel to enhance the hot workability by reducing the amount of sulfur and oxygen segregated to the grain boundaries. The total amount of Mg addition is limited to not more than 0.1% (col. 6 lines 47-60). It would have been obvious to one of ordinary skill in the art at the time the invention was made to add up to 0.10% Mg as taught by Uchara et al. to the maraging steel melt of Coutu to enhance the hot workability as taught by Uchara et al. The range of up to 0.1 % Mg overlaps with the claimed range of at least 5 ppm (0.0005 %). It would have been obvious to one of ordinary skill in the art to add between 0.0005 % and 0.10 % Mg to the maraging steel melt of Coutu in view of Uchara et al., since Coutu in view of Uchara et al. teaches that up to 0.10% is beneficial for improving the steel hot workability (Uchara et al., col. 6 lines 48-60).

Claims 2-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Coutu (U.S. Pat. No. 6,663,730) in view of Uehara et al. (U.S. Pat No. 6,562,153) and further in view of the ASM Metals Handbook, 1998).

Coutu in view of Uehara et al. discloses a method for producing a maraging steel by producing a consumable electrode for vacuum remelting then remelting the electrode by vacuum arc remelting processes as described above.

Coutu in view of Uehara et al. does not disclose that the consumable electrode used in the vacuum arc remelting is produced by vacuum induction melting (VIM) as in instant claim 2.

The ASM Metals Handbook teaches that most maraging steels are produced by air melting then vacuum arc remelting (VAR) or by VIM followed by VAR. For premium grades, triple melting is used, consisting of air, VIM, then VAR (p. 265). It would have been obvious to one of ordinary skill in the art at the time the invention was made to add a VIM step as taught by the ASM Metals Handbook to the melting process of Coutu in view of Uhara et al. to produce premium grades of maraging steel as taught by the ASM Metals Handbook.

With respect to claim 3, the vacuum remelting is conducted in a vacuum arc remelting process (Coutu col. 2 lines 31-45). With respect to claim 4, the steel is hot-rolled, pickled then cold-rolled to produce thin strips of thickness from 0.2 to 0.4 mm (Coutu col. 2 lines 51-55), which represents a plastic deformation (abstract).

Claims 5-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Coutu (U.S. Pat. No. 6,663,730) in view of Zeze et al. (U.S. Pat. No. 6,918,969) and further in view of Ueda et al. (U.S. Pat. No. 6,776, 855).

Coutu discloses a method for producing maraging steel as discussed above. Further, Coutu teaches producing a maraging steel strip with oxygen content not

exceeding 0.001 % and nitrogen not exceeding 0.003 % (col. 6 lines 6-35). The range of oxygen content not exceeding 0.001% overlaps with the claimed oxygen content of more than zero and less than 10 ppm (0.001%). It would have been obvious to one of ordinary skill in the art to limit the oxygen content in the melt of Coutu to greater than zero and less than 10 ppm, since Coutu teaches that any concentration not exceeding 0.001 % will produce the maraging steel strip. The range of nitrogen content not exceeding 0.003% overlaps with the claimed range of less than 15 ppm (0.00015%). It would have been obvious to one of ordinary skill in the art at the time the invention was made to limit the nitrogen content in the melt of Coutu to less than 15 ppm, since Coutu discloses that any concentration not exceeding 0.003% will produce the maraging steel strip.

Coutu does not teach the addition of more than zero and less than 10 ppm Mg. Zeze et al. discloses a method for casting steel (abstract) wherein magnesium is added between 0.0005 to 0.010 % by mass to act as assist in crystal nucleation and produce a finer crystal structure, reducing surface defects (col. 43 lines 14-37). It would have been obvious to one of ordinary skill in the art at the time the invention was made to add between 0.0005 to 0.010 % by mass Mg as taught by Zeze et al. to the melt of Coutu to produce a finer crystalline structure resulting in fewer surface defects as taught by Zeze et al. The range of between 0.0005 to 0.010 % by mass Mg overlaps with the claimed range of more than 0 and less than 10 ppm (0.001%) Mg. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use between 0.0005 and 0.001 % Mg to the melt of Coutu in view of Zeze et al. since Coutu in view

of Zeze et al. teaches that the entire range from 0.0005 to 0.010 % by mass Mg is beneficial for reducing surface defects (Zeze et al. col. 43 lines 14-37).

The oxides produced in the method of Coutu in view of Zeze et al. include alumina ( $\text{Al}_2\text{O}_3$ ) and spinel ( $\text{MgAl}_2\text{O}_4$ ) (Zeze et al. Table 9).

Coutu in view of Zeze et al. does not teach that the nitride inclusions should be no more than 15  $\mu\text{m}$  in length, the oxide inclusions no more than 20  $\mu\text{m}$  in length or that some portion of the oxide inclusions should be a size not less than 10  $\mu\text{m}$  in length as in instant claim 5.

Ueda et al. discloses a method for producing a maraging steel with excellent fatigue characteristics (abstract) by keeping the size of non-metallic inclusions less than 30  $\mu\text{m}$  in length (col. 15, lines 24-30). Nitride, oxide, alumina and spinel inclusion in the instant claim 5 are all non-metallic inclusions. It would have been obvious to one of ordinary skill in the art at the time the invention was made to limit the size of non-metallic inclusions to less than 30  $\mu\text{m}$  as taught by Ueda et al. in the maraging steel of Coutu in view of Zeze et al. to produce a maraging steel with excellent fatigue characteristics as taught by Ueda et al.

The range of less than 30  $\mu\text{m}$  overlaps with the claimed ranges of nitrides no more than 15  $\mu\text{m}$  in length and oxide inclusions no more than 20  $\mu\text{m}$  in length, with some being at least 10  $\mu\text{m}$  in length in instant claim 5. It would have been obvious to one of ordinary skill in the art at the time the invention was made to limit the size of nitride inclusions to less than 15  $\mu\text{m}$ , oxides to less than 20  $\mu\text{m}$ , with some oxide inclusions at least 10  $\mu\text{m}$ , since Coutu in view of Zeze et al. and Ueda et al. teach that

keeping the non-metallic inclusion size to any value less than 30  $\mu\text{m}$  produces a maraging steel with excellent fatigue properties (Ueda et al. abstract and col. 15, lines 24-30).

With respect to claim 6, the claimed ranges overlap with ranges disclosed by Coutu in view of Zeze et al. and Ueda et al. (Coutu col. 6 lines 15-36 and Ueda et al. col. 1 line 60 – col. 5 line 7). The table below compares the claimed composition ranges with the ranges of primary alloying elements disclosed in Coutu.

Element	Instant Claim 6	Coutu col. 6 lines 15-36
C	0.01 %	$\text{C} \leq 0.005 \%$
Ni	8.0 to 22.0 %	$12 \leq \text{Ni} \leq 24.5\%$
Co	5.0 to 20.0%	$4.17 \leq \text{Co} \leq 20\%$
Mo	2.0 to 9.0 %	$2.5 \leq \text{Mo} \leq 12\%$
Ti	$\leq 2.0\%$	$\leq 0.1\%$
Al	$\leq 1.7\%$	$\leq 0.15 \%$
Mg, O, N	See above discussion of instant claim 5	
Impurities + Fe	Balance	Balance

The ranges disclosed in Coutu for C, Ti and Al are within the claimed ranges. The ranges for Ni, Co and Mo overlap. It has been well settled that where the applied prior art teaches a range of compositions or properties overlapping a claimed range, a *prima facie* case of obviousness exists (M.P.E.P § 2144.05). It would have been obvious to one of ordinary skill in the art at the time the invention was made to prepare the maraging steel alloy of Coutu in view of Zeze et al. and Ueda et al. using between 12 and 22% Ni, 5 and 20% Co and 2.5 to 9% Mo, since Coutu in view of Zeze et al. and Ueda et al. teaches that any value of Ni between 12 and 24.5 %, Co between 4.17 and 20% and Mo between 2.5 and 12% has the same utility in producing the maraging steel strips.

With respect to claims 7 and 8, the thin steel strip has a thickness of between 0.2 and 0.4 mm (Coutu col. 2 lines 51-54) that is within the claimed range of less than 0.5 mm.

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kathleen A. McNelis whose telephone number is 571-272-3554. The examiner can normally be reached on M-F 8:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on 571-272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

ROY KING  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 1700